



BERYL
绿宝石



PRODUCT CATALOG

EDLCON SUPERCAPACITOR 2019

EDLCON®

公司简介

Company Profile

绿宝石始终坚持科技创新，致力于高端液态电容器、导电聚合物固态电容器和超级电容器产品的研发和生产，拥有“BERYL”、“G”、“EDLCON”三大品牌，提供优质电容器产品，满足不同应用需求。其中超级电容器产品涵盖导针型、牛角型、两端引出型三种结构，包含标准型（BCS）、高容量型（BCC）、低内阻型（BCE）三大系列单体及模组，并提供单体和模组定制以及配套能源管理系统设计服务。

本公司已通过ISO9001、ISO14001、IATF16949以及知识产权管理体系认证，申请多项专利，组建了“广东省高性能电容器工程技术研究中心”，并被认定为“广东省级企业技术中心”。拥有日本、德国、美国技术合作团队，并与多家高校科研院所实现产学研合作。

绿宝石秉持“品质取信，服务取胜，变革创新，超越期望”的质量方针，同时奉行“遵守法规，拒用毒物，预防污染，节约资源”的环保方针，以“在客户的立场想，在专业的角度做，在共赢的层面定”的服务承诺，为客户提供优质产品和服务。

Beryl company is committed to development and production of high performance E-Caps, Polymer Caps and Super Capacitor. The company offers multiple series of high quality capacitors to satisfy wide application, and it owns three renowned brands of “BERYL”, “G” and “EDLCON”. The EDLC products cover three structures of radial type, snap-in type and cylindrical type. There are three series of cell products and modules, including Standard Series (BCS), High Capacitance Series (BCC) and Low ESR Series (BCE). We also provide customized products and design services of relevant energy manage system.

Beryl are certified to ISO 9001, ISO14001, IATF16949 and IPMS (Intellectual Property Management System). It has applied for a number of patents, and organized “Guangdong high performance capacitor Engineering Technology Research Center”, which was identified as “Guangdong provincial enterprise technology center”. Beryl widely cooperates and communicates with experts at home and abroad in technology, by the way of building its foreign technical teams from Japan, German and American, and promoting the establishment of university-industry cooperations.

Beryl has been adhering to the quality policy of “Get confidence with quality, Get victory with service, Get leading with technology, Get exceeding on expectancy”, the environment policy of “Comply with regulations, Refuse to poisons, Prevent pollution, Save resources”, and the service commitment of “To stand on the position of the customer perspective, To manufacture in professional insight, To deal under win-win relationship”, to provide high quality products and services for customers.

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EDLC 超级电容器

Electric Double Layer Capacitor Introduction

RoHS
compliant

特性与优势 Features and Advantages

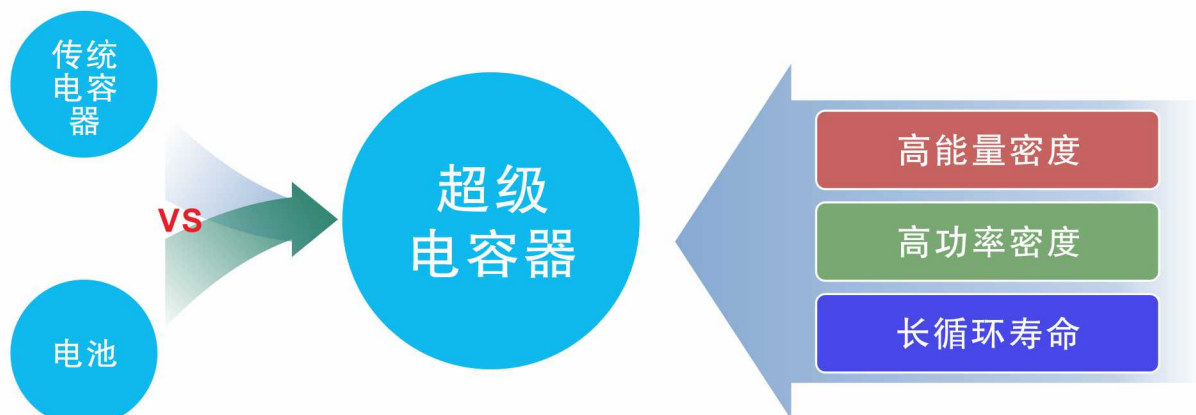
- 低内阻、高功率
 - 免维护(500,000次循环充放电,10年使用寿命)
 - 定制各类尺寸单体及模组
 - 定制各类耐高温、耐高压、超低ESR、超低自放电、超长寿命的单体。
 - 提供完整的系统解决方案
- Low ESR, high power
 - Maintenance-free (500,000 cycles of charge and discharge, ten years of service life)
 - Customized dimensions of products are available.
 - Provide customized special specifications, such as high temperature, high voltage, ultra-low ESR, ultra-low self discharge and longer life.
 - Offer integral system solution.

应用类型 Application Types

- 小功率短时间后备电源 Small power and short time backup supply
- 快速充放电 Fast charging and discharging
- 瞬间大功率支撑 Short-term peak power assistant
- 低温启动 Low temperature starting
- 工业储能及能量回收 Industrial energy storage and energy recovery
- 风光储能 Wind and Solar energy storage

应用领域 Application Areas

- 工业 Industry
- 消费电子产品 Consumer electronics
- 医疗 Medical treatment
- 交通运输 Traffic
- 军事 Military



产品概要

Product Outline

BCS 标准系列 BCS Standar Series

- 常规容量 Normal capacitance performance
- 工作温度 Operating temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- 额定电压 Rated voltage: 2.7V
- 尺寸 Size: $\Phi 8 \sim \Phi 35$
- 循环次数 Life cycles: $> 500,000$



BCC 高容量系列 BCC High Capacitance Series

- 高容量 High capacitance
- 工作温度 Operating temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- 额定电压 Rated voltage: 2.7V
- 尺寸 Size: $\Phi 8 \sim \Phi 60$
- 循环次数 Life cycles: $> 500,000$



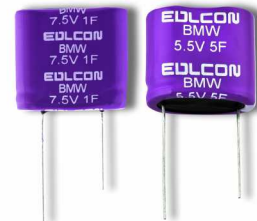
BCE 低内阻系列 BCE Low ESR Series

- 低内阻 Low ESR
- 工作温度 Operating temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- 额定电压 Rated voltage: 2.7V
- 尺寸 Size: $\Phi 8 \sim \Phi 12.5$
- 循环次数 Life cycles: $> 500,000$



BMW 微型模组系列 BMW Small Module Series

- 低漏电 Low leakage current
- 工作温度 Operating temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- 额定电压 Rated voltage: 5.5V, 7.5V
- 尺寸 Size: $\Phi 8 \sim \Phi 18$ 导针型产品2串/3串
2 or 3 capacitors of lead type in series



BMB 定制模组系列 BMB Customized Module Series

- 性能、尺寸定制满足不同使用需求
Customized performance and size to satisfy different use
- 提供能源管理系统设计
Design for energy management system
- 单体分选配组以提高模组可靠性
Cell was sorted and matched to improve reliability of module
- 工作温度 Operating temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$



产品编码

Part Number System

单体/微型模组编码 Cell and Small Module P/N

1 2 3	4 5 6	7	8 9 10	11 12	13 14	15 16						
BCS	2R7	M	506	YS	18	40						
系列 Series	代码 Code	电压 Vol (V)	代码 Code	容量偏差 Tol (%)	代码 Code	容量 Cap (F)	代码 Code	焊脚类型 Type	代码 Code	直径/宽度 Dia/Width (mm)	代码 Code	高度 Len (mm)
BCS	2R7	2.7	S	-20 ~ +50	334	0.33	YS	导针散装 Lead type bulk	08	8	12	12.0
BCC	3R0	3.0	M	-20 ~ +20	474	0.47	TZ	两针盖板 2-solder pin Snap-in	10	10	16	16.0
BCE	5R5	5.5	R	0 ~ +30	105	1.0	TK	四针盖板 4-solder pin Snap-in	1B	12.5	30	30.0
BMW	7R5	7.5	V	-10 ~ +30	255	2.5	TL	两片盖板 2-soldersheet Snap-in	16	16	40	40.0
			X	-20 ~ +100	335	3.3	CS	螺柱两端引出 Two ends with screw	18	18	60	60.0
					106	10	CC	光柱两端引出 Two ends without screw	22	22	66	66.0
					506	50	MA	导针两端引出 Lead at two end	25	25	85	85.0
					107	100	MB	导针中间引出 Lead in middle	30	30	1B	102.0
					367	360	MC	导针一侧引出 Lead at one side	35	35	1E	138.0
					128	1200			60	60		
					308	3000						

定制模组编码 Customized Module P/N

1 2 3	4 5 6 7	8	9 10 11 12	13 14	15 16	17						
BMB	0480	M	1650	ZA	A1	C						
系列 Series	代码 Code	电压 Vol (V)	代码 Code	容量偏差 Tol (%)	代码 Code	容量 Cap (F)	代码 Code	类型 Type	代码 Code	外壳类型 Outer shell	代码 Code	均衡方式 Circuit balanced mode
BMB	0055	5.5	S	-20 ~ +50	0R33	0.33	YA	PCB预留焊点 Without wire from PCB	01	无外壳 Without case	A	无均衡 Without balance
	0075	7.5	M	-20 ~ +20	0R47	0.47	LA	导线引出 Wire lead	T1	热缩套管 PET heat shrink tube	B	被动均衡 Passive balance
	0162	16.2	R	0 ~ +30	0015	1.5	BA	接线座引出 Connection box	S1	塑料外壳 Plastic shell with epoxy filling	C	主动均衡 Active balance
	0480	48.0	V	-10 ~ +30	0096	9.6	SA	连接片引出 Connection sheet	F1	烤漆铁皮外壳 Paint iron case		
	0850	85.0	X	-20 ~ +100	0220	22.0	ZA	接线柱引出 Terminal lead	G1	不锈钢外壳 Stainless steel case		
	1000	100.0			1650	165.0			A1	铝合金外壳 Aluminum case		
					5000	500.0						

BCS 标准型系列

BCS Standard Series

特点 Features

- 低自放电率、低漏电流 Low self-discharge and low leakage current
- 性能均衡、高可靠性 Consistent performance with high reliability
- 长寿命、免维护 Long life and free of maintenance



应用 Application

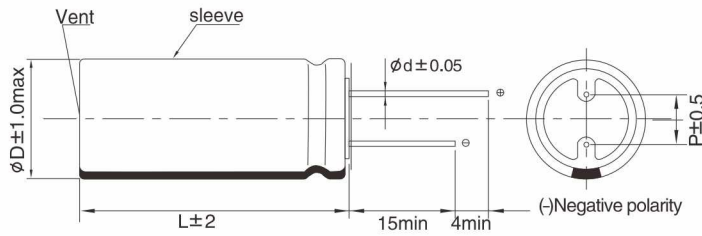
- 智能仪表 Smart meters
- 启动电源 Start power
- 后备电源 Back-up power

产品规格 Specifications

项目 Item	性能 Performance	
额定电压 Rated voltage	2.7 V	
浪涌电压 Surge voltage	2.85 V	
容量范围 Nominal cap. range	1.0 F ~ 500 F	
容量偏差 Capacitance tolerance	-20% ~ +50%; -20% ~ +20%; -10% ~ +30%	
工作温度 Operating temperature	-40°C ~ +70°C	
循环寿命 Cycle life characteristics	在25°C下, 以恒定电流使电容器在额定电压和半额定电压间循环充放电(>500,000次)。 Capacitors charge-discharge between rated voltage and half rated voltage under constant current at +25°C, (>500,000 cycles)	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
高温负荷寿命 High temperature load time	温度 Temperature: +70°C 电压 Voltage: 额定电压 Rated voltage 测试时长 Duration of testing: 2,000(+48)hrs	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
温度特性 Temperature characteristics	温度 Temperature: T ± 2°C (-40°C ≤ T ≤ +70°C) 测试时长 Duration of storage: 12hrs 无负载 Non-loaded	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
湿热特性 Humidity characteristic	电压 Voltage: 额定电压 Rated voltage 相对湿度 Relative humidity: 90%~95% 测试时长 Duration of testing: 240hrs 温度 Temperature: 40 ± 2°C	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
抗振性 Vibration resistance	振幅 Amplitude: 1.5mm 频率 Frequency: 10~55Hz 方向 Direction: X,Y,Z(2hrs) 测试时长 Duration of testing: 6hrs	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
外观变化 Appearance	无明显变化; No apparent change	

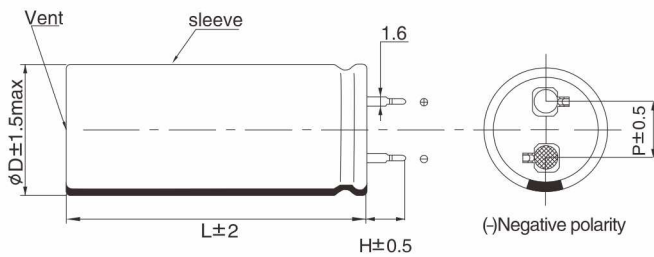
尺寸图示 Dimensions (mm)

• 导针型 Radial type



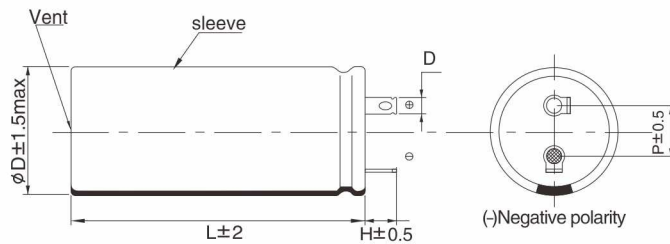
ΦD	8	10	12.5	16	18
P	3.5	5.0	5.0	7.5	7.5
Φd	0.6	0.6	0.6	0.8	0.8

• 牛角型 Snap-in type



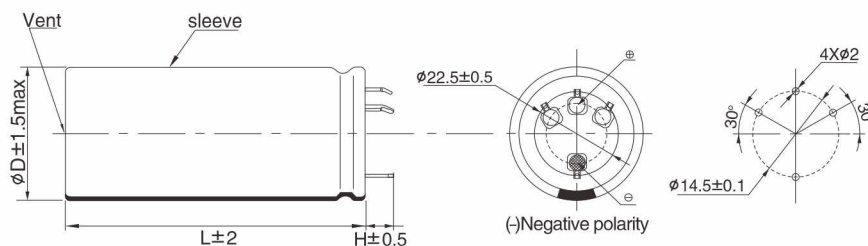
• 两针 TZ Type

ΦD	22	25	30	35
P	10	10	10	10
脚长 H	7.0	7.0	7.0	7.0



• 两L片 TL Type

ΦD	22	25	30	35
P	10	10	10	14
脚长 H	7.0	7.0	7.0	8.5



• 四针 TK Type

ΦD	35
P	22.5
脚长 H	7.0

典型产品 Standard Products

• 导针型 Radial type

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size Φ D × L (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current(A) (ΔT=15°C)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/mΩ)	ESR _{DC} IEC法 (mΩ)						
BCS2R7X105YS0812	2.7	1	8 × 12	160	240	0.47	1.09	0.006	4050	0.0010	1.13
BCS2R7S205YS0816	2.7	2	8 × 16	120	180	0.61	1.99	0.010	4459	0.0020	1.86
BCS2R7S335YS0820	2.7	3.3	8 × 20	100	150	0.74	2.98	0.012	4486	0.0033	2.57
BCS2R7S505YS0825	2.7	5	8 × 25	90	135	0.87	4.03	0.015	3857	0.0051	3.01
BCS2R7S505YS1020	2.7	5	10 × 20	75	113	0.97	4.32	0.015	3535	0.0051	2.30
BCS2R7M705YS1025	2.7	7	10 × 25	60	90	1.20	5.80	0.020	3738	0.0071	2.73
BCS2R7M106YS1030	2.7	10	10 × 30	45	68	1.51	8.06	0.030	4114	0.0101	3.21
BCS2R7M106YS1B20	2.7	10	12.5 × 20	45	68	1.42	8.06	0.030	3757	0.0101	2.94
BCS2R7M126YS1B25	2.7	12	12.5 × 25	40	60	1.66	9.42	0.040	3995	0.0132	3.61
BCS2R7M156YS1B30	2.7	15	12.5 × 30	35	53	1.93	11.33	0.052	3921	0.0162	3.81
BCS2R7M206YS1B35	2.7	20	12.5 × 35	30	45	2.23	14.21	0.056	3535	0.0203	3.68
BCS2R7M256YS1625	2.7	25	16 × 25	25	38	2.41	17.42	0.068	3110	0.0253	3.38
BCS2R7M306YS1630	2.7	30	16 × 30	20	30	2.92	21.32	0.075	3513	0.0304	3.66
BCS2R7M406YS1835	2.7	40	18 × 35	18	27	3.52	25.96	0.088	2893	0.0405	3.62
BCS2R7M506YS1840	2.7	50	18 × 40	16	24	3.96	30.68	0.105	2848	0.0506	3.96
BCS2R7M606YS1840	2.7	60	18 × 40	15	23	4.09	34.47	0.150	2880	0.0608	4.28
BCS2R7M107YS1860	2.7	100	18 × 60	13	20	5.30	45.76	0.240	2136	0.1013	4.82

• 牛角型 Snap-in type

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size Φ D × L (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current(A) (ΔT=15°C)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/mΩ)	ESR _{DC} IEC法 (mΩ)						
BCS2R7V107TZ2245	2.7	100	22 × 45	8.0	11.2	6.84	63.68	0.240	3633	0.1013	4.71
BCS2R7V127TZ2250	2.7	120	22 × 50	7.5	10.5	7.40	71.68	0.300	3086	0.1215	4.50
BCS2R7V157TZ2550	2.7	150	25 × 50	7.0	9.8	8.22	81.98	0.400	2705	0.1519	4.60
BCS2R7V227TZ3050	2.7	220	30 × 50	6.0	8.4	9.83	104.28	0.520	2340	0.2228	5.01
BCS2R7V257TZ3055	2.7	250	30 × 55	5.5	7.7	10.71	115.38	0.580	2470	0.2531	5.50
BCS2R7V367TZ3560	2.7	360	35 × 60	4.0	5.4	14.49	165.08	0.850	2282	0.3645	5.13
BCS2R7V407TZ3566	2.7	400	35 × 66	3.5	4.7	16.15	186.85	1.000	2178	0.4050	4.77

BCC 高容量型系列

BCC High Capacitance Series

特点 Features

- 高容量 High capacitance
- 低自放电率 Low self-discharge
- 长寿命 Long life

应用 Application

- 电动玩具 Electronic toy
- 后备电源 Back-up power
- 公交巴士 Bus

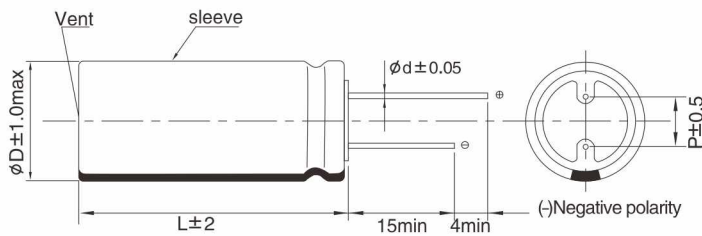


产品规格 Specifications

项目 Item	性能 Performance	
额定电压 Rated voltage	2.7 V	
浪涌电压 Surge voltage	2.85 V	
容量范围 Nominal cap. range	1.0 F ~ 3000 F	
容量偏差 Capacitance tolerance	-20% ~ +50%; -20% ~ +20%; -10% ~ +30%	
工作温度 Operating temperature	-40°C ~ +70°C	
循环寿命 Cycle life characteristics	在25°C下, 以恒定电流使电容器在额定电压和半额定电压间循环充放电(>500,000次)。 Capacitors charge-discharge between rated voltage and half rated voltage under constant current at +25°C, (>500,000 cycles)	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
高温负荷寿命 High temperature load time	温度 Temperature: +70°C 电压 Voltage: 额定电压 Rated voltage 测试时长 Duration of testing: 2,000(+48)hrs	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
温度特性 Temperature characteristics	温度 Temperature: T ± 2°C (-40°C ≤ T ≤ +70°C) 测试时长 Duration of storage: 12hrs 无负载 Non-loaded	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
湿热特性 Humidity characteristic	电压 Voltage: 额定电压 Rated voltage 相对湿度 Relative humidity: 90%~95% 测试时长 Duration of testing: 240hrs 温度 Temperature: 40 ± 2°C	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
抗振性 Vibration resistance	振幅 Amplitude: 1.5mm 频率 Frequency: 10~55Hz 方向 Direction: X,Y,Z(2hrs) 测试时长 Duration of testing: 6hrs	
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外观变化 Appearance	无明显变化; No apparent change	

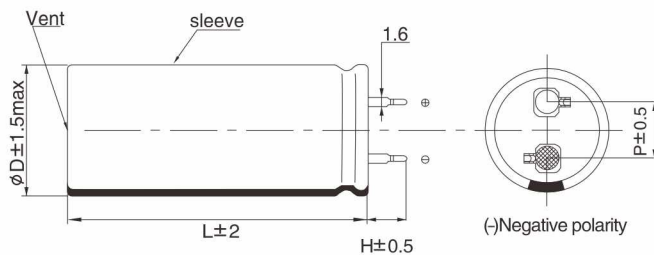
▶ 尺寸图示 Dimintions (mm)

• 导针型 Radial type



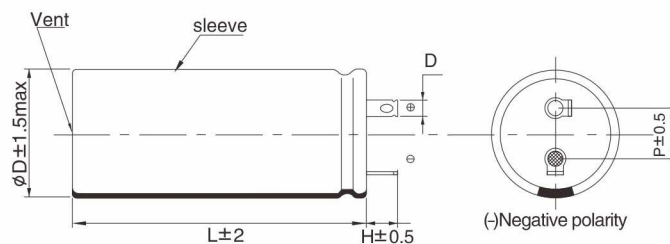
ϕD	8	10	12.5	16	18
P	3.5	5.0	5.0	7.5	7.5
ϕd	0.6	0.6	0.6	0.8	0.8

• 牛角型 Snap-in type



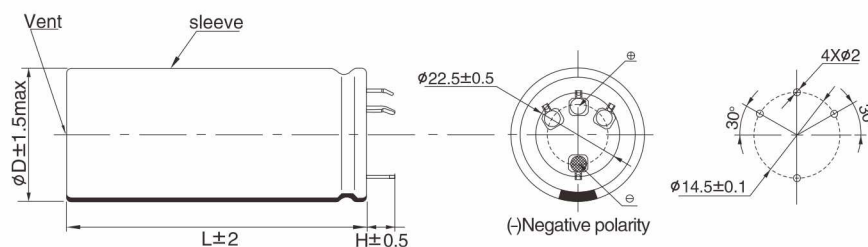
• 两针 TZ Type

ϕD	22	25	30	35
P	10	10	10	10
脚长 H	7.0	7.0	7.0	7.0



• 两L片 TL Type

ϕD	22	25	30	35
P	10	10	10	14
脚长 H	7.0	7.0	7.0	8.5



• 四针 TK Type

ϕD	35
P	22.5
脚长 H	7.0

典型产品 Standard Products

• 导针型 Radial type

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size $\Phi D \times L$ (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current (A) ($\Delta T=15^{\circ}C$)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/m Ω)	ESR _{DC} IEC法 (m Ω)						
BCC2R7S205YS0812	2.7	2	8 × 12	180	270	0.44	1.44	0.010	3600	0.0015	1.69
BCC2R7S305YS0816	2.7	3	8 × 16	130	195	0.59	2.56	0.012	4116	0.0030	2.79
BCC2R7S405YS0820	2.7	4	8 × 20	110	165	0.71	3.25	0.015	4078	0.0041	3.12
BCC2R7S505YS1016	2.7	5	10 × 16	90	135	0.80	4.03	0.020	3240	0.0051	2.53
BCC2R7M705YS1020	2.7	7	10 × 20	80	120	0.94	5.14	0.020	3314	0.0071	3.22
BCC2R7M106YS1025	2.7	10	10 × 25	65	98	1.15	6.84	0.030	3451	0.0100	3.89
BCC2R7M126YS1030	2.7	12	10 × 30	50	75	1.43	8.53	0.036	3703	0.0122	3.86
BCC2R7M126YS1B20	2.7	12	12.5 × 20	50	75	1.35	8.53	0.036	3381	0.0122	3.52
BCC2R7M156YS1B25	2.7	15	12.5 × 25	45	68	1.57	10.06	0.048	3551	0.0162	4.44
BCC2R7M206YS1B30	2.7	20	12.5 × 30	40	60	1.80	12.27	0.055	3431	0.0203	4.76
BCC2R7M256YS1B35	2.7	25	12.5 × 35	35	53	2.07	14.34	0.060	3030	0.0243	4.42
BCC2R7M286YS1625	2.7	28	16 × 25	26	39	2.37	17.75	0.070	2991	0.0270	3.65
BCC2R7M356YS1630	2.7	35	16 × 30	22	33	2.79	21.93	0.080	3194	0.0354	4.27
BCC2R7M506YS1835	2.7	50	18 × 35	20	30	3.34	27.00	0.100	2604	0.0506	4.52
BCC2R7M706YS1840	2.7	70	18 × 40	18	27	3.74	32.70	0.125	2531	0.0709	5.54
BCC2R7M117YS1860	2.7	110	18 × 60	15	23	4.93	42.73	0.260	1851	0.1114	5.30

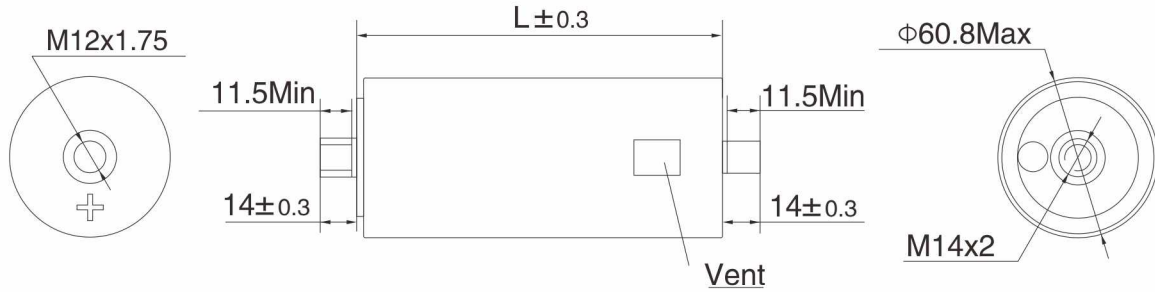
• 牛角型 Snap-in type

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size $\Phi D \times L$ (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current (A) ($\Delta T=15^{\circ}C$)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/m Ω)	ESR _{DC} IEC法 (m Ω)						
BCC2R7V117TZ2245	2.7	110	22 × 45	8.5	12	6.52	63.04	0.250	3301	0.1114	5.18
BCC2R7V137TZ2250	2.7	130	22 × 50	8.0	12	7.04	69.98	0.310	2793	0.1316	4.88
BCC2R7V177TZ2550	2.7	170	25 × 50	7.5	11	7.80	80.56	0.415	2438	0.1721	5.22
BCC2R7V257TZ3050	2.7	250	30 × 50	7.0	10	8.95	96.46	0.550	1937	0.2633	5.92
BCC2R7V307TZ3055	2.7	300	30 × 55	6.0	9	10.08	112.19	0.600	2186	0.3038	6.60
BCC2R7V407TZ3560	2.7	400	35 × 60	4.5	6	13.41	153.41	1.000	1956	0.4050	5.70
BCC2R7V457TZ3566	2.7	450	35 × 66	4.0	6	14.83	172.59	1.200	1838	0.4556	5.36
BCC2R7V507TZ3570	2.7	500	35 × 70	4.0	6	15.23	177.63	1.400	1644	0.5063	5.33

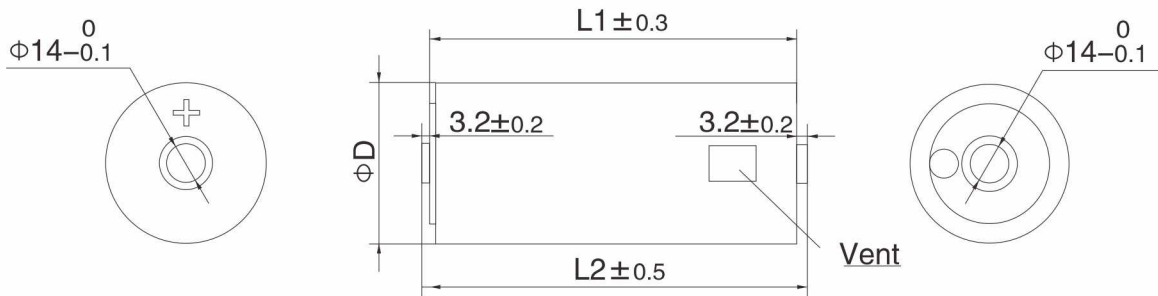
尺寸图示 Dimensions (mm)

• 两端引出型 Cylindrical type

• 螺柱 CS Type



• 光柱 CC Type



典型产品 Standard Products

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size Φ D × L (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current(A) (ΔT=15°C)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/mΩ)	ESR _{DC} IEC法 (mΩ)						
BCC2R7V657CS6051	2.7	650	60 × 51	0.60	0.72	54.00	597.75	1.70	7594	0.6581	4.11
BCC2R7V128CS6074	2.7	1200	60 × 74	0.40	0.55	70.00	975.90	2.80	6117	1.2150	4.67
BCC2R7V158CS6085	2.7	1500	60 × 85	0.33	0.45	84.00	1208.96	3.00	6943	1.5188	5.42
BCC2R7V208CS601X	2.7	2000	60 × 102	0.25	0.35	110.00	1588.24	4.20	6943	2.0250	5.63
BCC2R7V308CS601W	2.7	3000	60 × 138	0.22	0.26	130.00	2275.28	5.20	6729	3.0375	6.08

BCE 低内阻型系列

BCE Low ESR Series

特点 Features

- 超低内阻 Extremely low ESR
- 低漏电、高可靠性 Low leakage current and high reliability
- 长寿命、免维护 Long life and free of maintenance



应用 Application

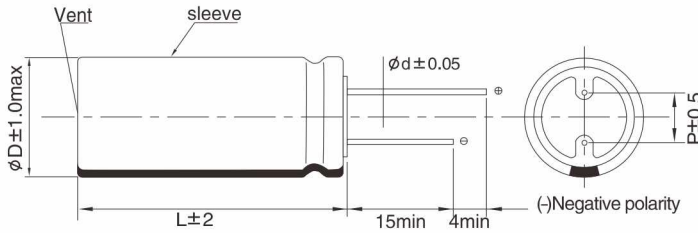
- 高端玩具 High-tech toy
- 启动电源 Start power
- 后备电源 Back-up power

产品规格 Specifications

项目 Item	性能 Performance	
额定电压 Rated voltage	2.7 V	
浪涌电压 Surge voltage	2.85 V	
容量范围 Nominal cap. range	1.0 F ~ 10 F	
容量偏差 Capacitance tolerance	-20% ~ +50%; -20% ~ +20%; -10% ~ +30%	
工作温度 Operating temperature	-40°C ~ +70°C	
循环寿命 Cycle life characteristics	在25°C下, 以恒定电流使电容器在额定电压和半额定电压间循环充放电(>500,000次)。 Capacitors charge-discharge between rated voltage and half rated voltage under constant current at +25°C, (>500,000 cycles)	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
外观变化 Appearance	无明显变化; No apparent change	
	温度 Temperature: +70°C	电压 Voltage: 额定电压 Rated voltage
	测试时长 Duration of testing: 2,000(+48)hrs	
高温负荷寿命 High temperature load time	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
	外观变化 Appearance	无明显变化; No apparent change
温度特性 Temperature characteristics	温度 Temperature: T ± 2°C (-40°C ≤ T ≤ +70°C)	测试时长 Duration of storage: 12hrs
	无负载 Non-loaded	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value	
	外观变化 Appearance	无明显变化; No apparent change
	湿度特性 Humidity characteristic	电压 Voltage: 额定电压 Rated voltage
测试时长 Duration of testing: 240hrs		温度 Temperature: 40 ± 2°C
容量变化 Capacitance change		≤ 初始值的30%; ≤ 30% of initial value
内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value	
	外观变化 Appearance	无明显变化; No apparent change
	抗振性 Vibration resistance	振幅 Amplitude: 1.5mm
方向 Direction: X,Y,Z(2hrs)		测试时长 Duration of testing: 6hrs
容量变化 Capacitance change		≤ 初始值的30%; ≤ 30% of initial value
内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value	
	外观变化 Appearance	无明显变化; No apparent change

尺寸图示 Dimentions (mm)

• 导针型 Radial type



ϕD	8	10	12.5	16	18
P	3.5	5.0	5.0	7.5	7.5
ϕd	0.6	0.6	0.6	0.8	0.8

典型产品 Standard Products

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size $\phi D \times L$ (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current (A) ($\Delta T=15^{\circ}\text{C}$)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/m Ω)	ESR _{DC} IEC法 (m Ω)						
BCE2R7X105YS0812	2.7	1	8 × 12	110	165	0.57	1.16	0.008	5891	0.0010	1.21
BCE2R7S205YS0816	2.7	2	8 × 16	90	135	0.71	2.13	0.013	5945	0.0020	1.86
BCE2R7S335YS0820	2.7	3.3	8 × 20	65	98	0.92	3.37	0.015	6902	0.0033	2.57
BCE2R7S505YS0825	2.7	5	8 × 25	55	83	1.11	4.78	0.020	6312	0.0051	3.01
BCE2R7S505YS1020	2.7	5	10 × 20	50	75	1.19	4.91	0.025	5302	0.0051	2.30
BCE2R7M705YS1025	2.7	7	10 × 25	30	45	1.70	7.19	0.030	7477	0.0071	2.73
BCE2R7M106YS1030	2.7	10	10 × 30	25	38	2.02	9.82	0.035	7406	0.0101	3.21
BCE2R7M106YS1B20	2.7	10	12.5 × 20	25	38	1.91	9.82	0.035	6762	0.0101	2.94

BMW 微型模组系列

BMW Small Module Series

特点 Features

- 低漏电, 长寿命 Low leakage current, long life
- 高能量、大功率 High power, high energy density
- 免维护 Maintenance-free
- 模组定制, 满足不同需求 Module customized to meet different requirement



应用 Application

- 智能仪表 Smart meters
- 智能家电 Intelligent home appliance
- 电动玩具 Electronic toy

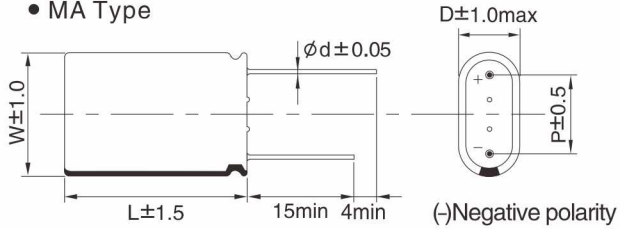
产品规格 Specifications

项目 Item	性能 Performance	
额定电压 Rated voltage	5.5 V; 7.5 V	
容量范围 Nominal cap. range	0.33 F ~ 50 F	
容量偏差 Capacitance tolerance	-20% ~ +50%; -20% ~ +20%	
工作温度 Operating temperature	-40°C ~ +70°C	
循环寿命 Cycle life characteristics	在25°C下, 以恒定电流使电容器在额定电压和半额定电压间循环充放电(>500,000次)。 Capacitors charge-discharge between rated voltage and half rated voltage under constant current at +25°C, (>500,000 cycles)	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
	外观变化 Appearance	无明显变化; No apparent change
高温负荷寿命 High temperature load time	温度 Temperature: +70°C 电压 Voltage: 额定电压 Rated voltage 测试时长 Duration of testing: 2,000(+48)hrs	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
	外观变化 Appearance	无明显变化; No apparent change
温度特性 Temperature characteristics	温度 Temperature: T ± 2°C (-40°C ≤ T ≤ +70°C) 测试时长 Duration of storage: 12hrs 无负载 Non-loaded	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
	外观变化 Appearance	无明显变化; No apparent change
湿热特性 Humidity characteristic	电压 Voltage: 额定电压 Rated voltage 相对湿度 Relative humidity: 90%~95% 测试时长 Duration of testing: 240hrs 温度 Temperature: 40 ± 2°C	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
	外观变化 Appearance	无明显变化; No apparent change
抗振性 Vibration resistance	振幅 Amplitude: 1.5mm 频率 Frequency: 10~55Hz 方向 Direction: X,Y,Z(2hrs) 测试时长 Duration of testing: 6hrs	
	容量变化 Capacitance change	≤ 初始值的30%; ≤ 30% of initial value
	内阻变化 Internal resistance	≤ 初始值的2倍; ≤ 2 times of initial value
	外观变化 Appearance	无明显变化; No apparent change

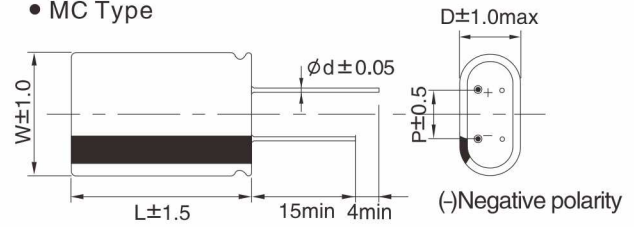
尺寸图示 Dimentions (mm)

• 5.5V-2串 / 2 cells in series connection

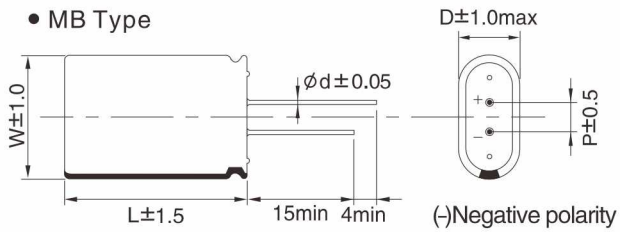
• MA Type



• MC Type



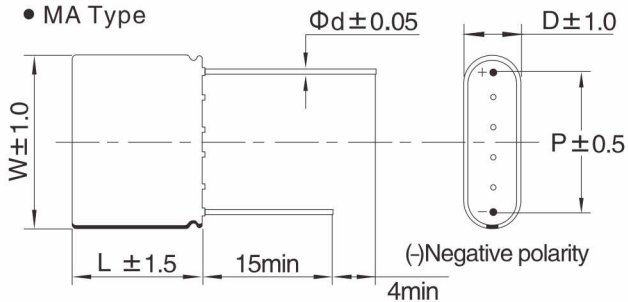
• MB Type



串联状况 connection mode	单体直径 Cell Dia.	D	W	脚距/P			Φd
				MA	MB	MC	
两串 2 in series	Φ8	8	16	11.5	5.0	8.0	0.6
	Φ10	10	20	15.5	5.5	10.0	0.6
	Φ12.5	13	25	18.0	7.5	13.0	0.6
	Φ16	16	32	24.0	8.5	16.0	0.8
	Φ18	18	36	26.0	10.5	/	0.8

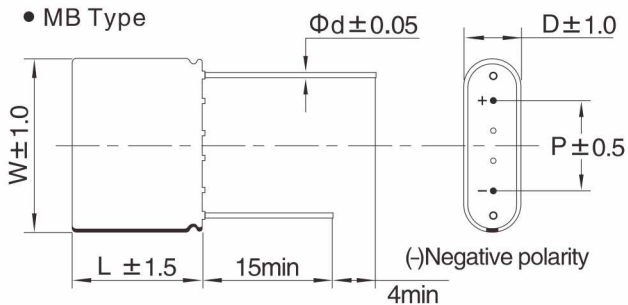
• 7.5V-3串 / 3 cells in series connection

• MA Type



串联状况 connection mode	单体直径 Cell Dia.	D	W	脚距/P			Φd
				MA	MB	MC	
三串 3 in series	Φ8	8	24	20.5	13.5	/	0.6

• MB Type



典型产品 Standard Products

• 5.5V-2串 / 2 cells in series connection

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size W × D × L (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current(A) ($\Delta T=15^{\circ}\text{C}$)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/m Ω)	ESR _{DC} IEC法 (m Ω)						
BMW5R5X474MA0814	5.5	0.47	16 × 8 × 14	320	480	0.47	1.05	0.006	3601	0.0020	0.94
BMW5R5S105MA0814	5.5	1	16 × 8 × 14	360	540	0.44	1.79	0.006	2923	0.0042	1.83
BMW5R5S105MA0818	5.5	1	16 × 8 × 18	240	360	0.61	2.02	0.010	4201	0.0042	1.75
BMW5R5S155MA0822	5.5	1.5	16 × 8 × 22	200	300	0.74	2.84	0.012	4172	0.0063	2.17
BMW5R5S255MA0827	5.5	2.5	16 × 8 × 27	180	270	0.87	4.10	0.015	3447	0.0105	2.69
BMW5R5S255MA1018	5.5	2.5	20 × 10 × 18	180	270	0.80	4.10	0.015	3056	0.0105	2.39
BMW5R5S255MA1022	5.5	2.5	20 × 10 × 22	150	225	0.97	4.40	0.015	3361	0.0105	2.19
BMW5R5M355MA1022	5.5	3.5	20 × 10 × 22	160	240	0.94	5.23	0.020	3151	0.0147	3.06
BMW5R5M355MA1027	5.5	3.5	20 × 10 × 27	120	180	1.20	5.90	0.020	3667	0.0147	2.67
BMW5R5M505MA1027	5.5	5	20 × 10 × 27	130	195	1.15	6.96	0.030	3385	0.0210	3.82
BMW5R5M505MA1032	5.5	5	20 × 10 × 32	90	135	1.51	8.21	0.030	4074	0.0210	3.18
BMW5R5M505MA1B22	5.5	5	25 × 13 × 22	90	135	1.42	8.21	0.030	3634	0.0210	2.84
BMW5R5M655MA1B27	5.5	6	25 × 13 × 27	80	120	1.66	9.59	0.040	3929	0.0252	3.27
BMW5R5M755MA1B32	5.5	7.5	25 × 13 × 32	70	105	1.93	11.54	0.052	3841	0.0315	3.50
BMW5R5M106MA1B32	5.5	10	25 × 13 × 32	80	120	1.80	12.50	0.055	3361	0.0420	4.67
BMW5R5M106MA1B37	5.5	10	25 × 13 × 37	60	90	2.23	14.47	0.056	3507	0.0420	3.65
BMW5R5M1B6MA1627	5.5	12.5	32 × 16 × 27	50	75	2.41	17.74	0.068	3103	0.0525	3.37
BMW5R5M156MA1632	5.5	15	32 × 16 × 32	40	60	2.92	21.71	0.075	3517	0.0630	3.66
BMW5R5M206MA1837	5.5	20	36 × 18 × 37	36	54	3.52	26.44	0.088	2988	0.0840	3.73
BMW5R5M256MA1842	5.5	25	36 × 18 × 42	32	48	3.96	31.25	0.105	2875	0.1050	3.99
BMW5R5M306MA1842	5.5	30	36 × 18 × 42	30	45	4.09	35.11	0.145	2881	0.1260	4.50
BMW5R5M506MA1862	5.5	50	36 × 18 × 62	26	39	5.30	46.61	0.240	2165	0.2101	4.89

• 7.5V-3串 / 3 cells in series connection

产品编码 Part number	额定电压 Rated Voltage (V)	标称容量 Rated Cap. (F)	尺寸 Size W × D × L (mm)	最大等值阻抗 Max. ESR		最大工作电流 Maximum Continuous Current(A) ($\Delta T=15^{\circ}\text{C}$)	最大峰值电流 Maximum Peak Current (A)	最大漏电流 Maximum Leakage Current (72hrs/mA)	功率密度 Power Density (W/kg)	最大能量 Maximum Energy (W.h)	能量密度 Energy Density (Wh/kg)
				ESR _{AC} (1kHz/m Ω)	ESR _{DC} IEC法 (m Ω)						
BMW7R5S334MB0814	7.5	0.33	24 × 8 × 14	480	720	0.38	1.00	0.006	3125	0.0026	0.86
BMW7R5S604MB0818	7.5	0.6	24 × 8 × 18	360	540	0.50	1.70	0.010	3472	0.0047	1.30
BMW7R5S105MB0822	7.5	1	24 × 8 × 22	300	450	0.61	2.59	0.012	3488	0.0078	1.82

BMB 定制模组系列

BMB Customized Module Series

定制模组 Custom module

- 根据客户需求定制各种规格、尺寸模组产品，提供完整能源系统解决方案，满足客户不同储能、功率要求。
- Design different performance and size of module, provide integrate solution of power system, to satisfy different application in power output and energy storage.

模组设计案例 Designed module examples

产品型号 项目 Item	13.5V 44F	48V 22F	48V 165F
额定电压 Rated voltage	13.5V	48V	48V
额定容量 Rated capacity	44F	22F	165F
ESR _{DC}	≤45mΩ	≤65mΩ	≤6.0mΩ
最大峰值电流 Maximum peak current	100A	220A	1990A
外包装方式 Outer packing	塑料套管热缩 Heat-shrinkable plastic sleeve	塑料套管热缩 Heat-shrinkable plastic sleeve	金属外壳 Metal case
绝缘耐压特性 Voltage withstand characteristic	直流DC: 1KV, 交流AC: 2.5KV		
工作温度范围 Operating temp. range	-40~+70℃		
均衡方式 Balancing mode	主动 Active		主动+被动 Active & Passive
均衡开启电压 Balancing threshold voltage	2.65V	2.6~2.7V	2.65V
尺寸 Size	155 × 32 × 62mm	250 × 115 × 80mm	416 × 190 × 217mm
应用原理 Application principle	摩托车低温启动 Low temperature start-up for motorcycle	36V电动自行车辅助电源 36V auxiliary power supply for electric bicycle	风电变桨及其他储能系统 Wind turbine pitch and other energy storage systems



模组设计说明 Description of module design

● 单体分选 Cells separation

- ◆ 超级电容单体按容量及内阻进行分档，并对漏电流和自放电进行分选，以提高超级电容单体配组的精准度，提高模组产品的可靠性及稳定性。
- ◆ Cells can be classified by capacitance, internal resistance, leakage current and self discharge to improve precision of the group matching, so as to improve the reliability and stability of the module.

● 电路设计 Circuit design

- ◆ 功能：根据客户需求专门设计
- ◆ 性能：根据客户应用负载特性优化设计
- ◆ 均衡：主动+被动均衡
- ◆ 检测：单体过充检测、过温检测、反充检测等
- ◆ 通讯：根据客户需求，可设计 SPI、RS232、RS485、CAN、12C、SMBUS、以太网及光纤通讯等多种通讯方式同
- ◆ PCB：用料扎实，牢固，内阻小、过电流高、散热好
- ◆ 附加功能：监测每并模组电压、计算模组剩余容量、甚至每只单体剩余容量及健康状况等
- ◆ Function: design by client's requirement.
- ◆ Property: design by client's applicated load characteristic
- ◆ Balance mode: active and passitive
- ◆ Detection: cell's over-charge test, over temperature test, counter charging test, etc.
- ◆ Communication mode: designed according to client's requirement, such as mode of SPI、RS232、RS485、CAN、12C、SMBUS ethernet or optical fiber communication
- ◆ PCB: sturdy, firm, low internal resistance, high overcurrent, good property of heat dissipation
- ◆ Additional function: monitoring voltage of every parallel module, calculate surplus capacitance of module, and even surplus capacitance and conditions of each cell

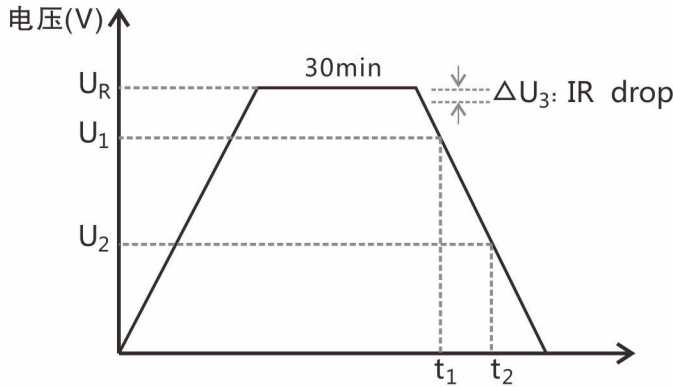
● 结构设计 Structure design

- ◆ 单体与模组互相配合
- ◆ 采用CAM三维设计
- ◆ 结构简单，方便易装
- ◆ 牢固结实，强度高，抗破坏性强
- ◆ 辅助配件精挑细选，保证在恶劣的环境中也能正常使用
- ◆ Cells and module work in coordination
- ◆ Design by CAM 3D
- ◆ Simple structure, easy for packing
- ◆ Firm, high strength, good property of damage resistance
- ◆ Carefully choose accessories to ensure normal use in hostile environment.

技术信息

Technical Information

IEC容量测试方法 IEC Capacity Test Method



容量计算公式:
Capacitance calculation fomula:

$$C = \frac{IX(t_2 - t_1)}{U_1 - U_2}$$

其中:

I : 放电电流 Discharge current

$$I = 4 \times C \times U_R (\text{mA})$$

U_1 : 初始电压 Initial voltage

$$U_1 = 0.8 \times U_R (\text{V})$$

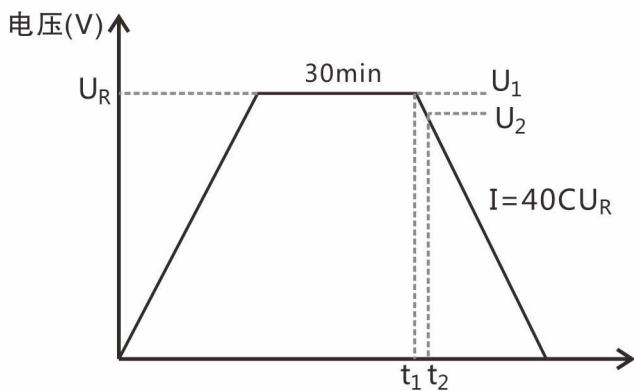
U_2 : 测量结束电压 Test finish voltage

$$U_2 = 0.4 \times U_R (\text{V})$$

t_1 : 初始电压 U_1 对应的时间 Time corresponding to initial voltage (s) ;

t_2 : 测量结束电压 U_2 对应的时间 Time corresponding to test finish voltage (s) ;

IEC ESR_{DC} 测试方法 IEC ESR_{DC} Test Method



ESR_{DC}计算公式:
ESR_{DC} Calculation fomula:

$$ESR_{DC} = \frac{U_1 - U_2}{I}$$

其中:

I : 放电电流 Discharge current

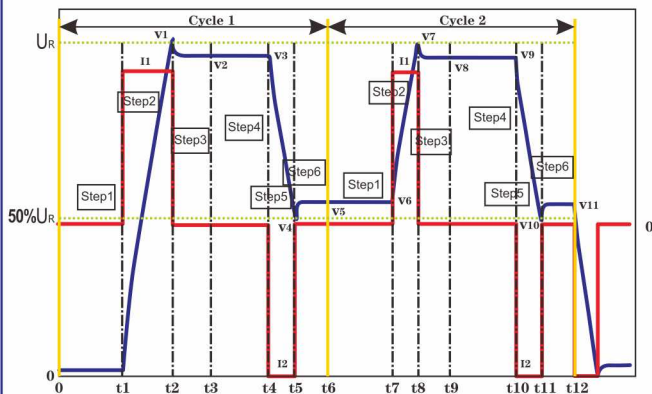
$$I = 40 \times C \times U_R (\text{mA})$$

U_1 : 放电初始电压 Initial voltage at discharge beginning;

U_2 : 放电10ms后结束电压 Finish voltage after 10 msec' s discharge;

Δt : 放电时长 Time for discharge $\Delta t = (t_2 - t_1) = 10 \text{msec}$

六步法容量及ESR_{DC}测试方法 Capacity and ESR_{DC} Test Method by six steps



计算公式 Calculation formula:

两次循环放电容量 capacitance of the two cycle:

$$Cdch1 = I2 \times (t5 - t4) / (V3 - V4); \quad Cdch2 = I2 \times (t11 - t10) / (V9 - V10);$$

两次循环放电直流内阻 Discharge DC internal resistance:

$$ESRdch1 = (V5 - V4) / I2; \quad ESRdch2 = (V11 - V10) / I2;$$

放电容量 Discharge capacitance:

$$Cdch = (Cdch1 + Cdch2) / 2;$$

放电直流内阻 Discharge DCESR:

$$ESRdch = (ESRdch1 + ESRdch2) / 2;$$

其中: $I1 = I2 = 75 \text{ mA/F}$

测试步骤 Test steps:

step1: 搁置10s;

Rest (Open Circuit) 10 seconds;

step2: 以电流I1恒流充电至额定电压U_R;

Charge device to its rated voltage at constant current I1;

step3: 搁置5s;

Rest (Open Circuit) 5 seconds;

step4: 搁置10s, 记录t₄、V₃;

Rest 10 seconds. Record test time and voltage at end of test (t₄, V₃);

step5: 以电流I₂恒流放电至50%U_R, 记录I₂、V₄、t₅;

Discharge device to one-half its rated voltage at constant current I2. Record test current, test time and voltage at end of the test (I₂, t₅, V₄);

step6: 搁置5s, 记录t₆、V₅;

Rest 5 seconds. Record test time and test voltage at end of the rest (t₆, V₅);

重复step1~step6, 并记录对应的电流、电压和时间, 最后以电流I₂恒流放电至0.1V以下。

Repeat Step 1 to step 6. Discharge device to low safe voltage (<0.1V) after the second cycle at current I2.

其他Others

- 最大工作电流: 15°C温升时的最大工作电流

Maximum operating current: the maximum current when temperature rised 15°C

$$I_{MAX} = \sqrt{15 \times S_{表} / ESR_{DC}}$$

- 最大峰值电流: 1秒钟放电至1/2U_R的最大放电电流

Maximum peak current: the maximum current which the capacitor discharges from U_R to 1/2U_R in 1 second.

$$I_{MAX} = 0.5U_R / (R_{DC} + 1/C)$$

- 漏电流: 25°C下恒压72小时后的泄漏电流

Leakage current: the current after 72 hours constant voltage load in 25°C

- 最大储存能量 Maximum storage energy :

$$E = 0.5CU_R^2$$

- 功率密度 Power density:

$$Pd = (0.12 \times U_R^2 / ESR_{DC}) / \text{mass}$$

- 能量密度 Energy density

$$Ed = (0.5CU_R^2) / (3600 \times \text{mass})$$

使用说明

Instruction

此文档将提供双电层电容器 (EDLC) 基本应用开发指南。若在开发使用过程中遇到问题且在此文件中找不到相关解决方案, 请直接与我们联系。

This document provides basic guidelines for application development using Electric Double Layer Capacitors (EDLC). If there is any questions during your development process that are not answered in the document, please contact us directly.

1、寿命 Lifetime

EDLC基本的寿命终止失效模式为容量下降、等效串联阻抗 (ESR) 增加, 通常以容量下降30%、阻抗增加200%之性能变化作为寿命终止之标准。EDLC只是在其使用期内性能不断衰减, 而非真正报废。当性能不再能保持在应用要求的水平时, 超级电容器将报废。

EDLC的寿命主要受工作电压和温度的影响。将电容器置于高温、高电压下会导致寿命缩短。如果持续过压, EDLC内将会产生气体, 导致漏液或防爆阀打开。高温下电容器ESR升高会导致电解液分解、EDLC永久劣化。

The basic end-of life failure mode for the EDLC is a decrease in capacitance and/or an increase in equivalent series resistance (ESR). Usually take the standard of capacitance decrease by 30% and/or ESR increase to 200% as the symbol of EDLC life end. Just the performance of EDLC will continue to decay during the application, but not to be scrapped. When its performance can not keep at the application level required, the super capacitor will be scrapped.

The EDLC's life mainly depends on working voltage and ambient temperature. If the capacitors are placed in high temperature or work at high voltage, their life time will be shortened. If the applied voltage is over rated voltage for long time, gas generation will occur inside the EDLC and may result in electrolyte leakage or rupture of safety vent. Increased ESR at higher temperature will lead to electrolyte decompose inside the EDLC and result in permanent degradation.

2、反向电压 Reverse voltage

EDLC的正、负极由相同材料组成。理论上EDLC没有真正的极性。出于制造和一致性目的, 每一个电容器有负极框或符号来标识极性。虽然EDLC被反向充电不会引发灾难性的故障, 但保持极性是推荐的做法。如果在一方向上长期充电后再进行反向充电, EDLC的寿命将会大大的缩短。

The positive and negative polarity of EDLC are similar in composition. So there's no real polarity for EDLC in theory. To keep consistency of manufacture and products, there's negative polarity sign on each capacitor. It is recommended to keep right polarity, though it will not cause disastrous failure when reverse charge. It will greatly shorten the life of EDLC when charge it in one polarity for long and then reverse charge.

3、温度表现 Temperature performance

绿宝石公司的EDLC标准工作温度范围为-40°C~+70°C。EDLC在高于额定温度下使用, 将导致容量快速下降, ESR上升, 电解液分解而产生大量气体, 最终导致产品漏液或防爆阀打开。温度越高、持续时间越长则性能劣化越严重。

一般来说, 环境温度每升高10°C, EDLC的寿命就会缩减一半; 在低于正常室温下使用时, EDLC的使用电压可以稍高于额定电压而不会造成内部劣化和寿命缩短。因此, 建议尽可能降低温度使用。在低温下电解液粘性提升, 离子的移动变得缓慢, ESR升高只是一种短暂现象; 在高温时ESR的升高, 电解液发生分解造成EDLC性能永久性劣化。环境温度加上内部温升应控制在额定上限温度之下。降低温度使用可提高产品工作电流或延长产品寿命。

BERYL EDLC normal working temperature is $-40^{\circ}\text{C}\sim+70^{\circ}\text{C}$. If the EDLC is applied in higher temperature than rated temperature, it will cause capacitance decrease quickly, ESR increase and decomposition of electrolyte, which will produce a large volume of gas, then lead to electrolyte leakage or rupture of safety vent. The higher the temperature and the longer the time, the performance of EDLC will be worse.

Generally, the ambient temperature raise by every 10°C , the life time of EDLC will shorten by half. At temperature lower than normal room temperature, it is possible to apply voltages slightly higher than the rated voltage without significant effects of degradation in performance and reduction in life time. Therefore, it is recommended to use EDLC in low temperature. At low temperature, increased ESR is only a temporary phenomenon due to the increased viscosity of the electrolyte and slower movement of the ions. At high temperature, ESR increasing will result in permanent degradation and electrolyte decomposition inside the EDLC. The total temperature, ambient temperature add internal temperature rise, should be controlled under the rated maximum temperature. Larger working current and longer life time can be obtained when introduce cooler environment.

4、充电方法 Charge method

EDLC主要是通过静电电荷在活性碳电极表面进行物理性吸附/脱附，瞬间存储能量，充放电过程不发生化学反应，因此可采用大倍率快速充放电。EDLC可采用多种方法进行充电，包括恒定电流、恒定电压、恒定功率或与能量储存器（例如电池）进行并联充电。如果EDLC与电池并联，加一个低阻值串联电阻将会提升电池的寿命。

EDLC stores energy by the physical mechanism of electric charge absorption/desorption at the surface of active carbon electrode. There is not chemical reaction during charge-discharge process, so it can be charged or discharged fast with high current. EDLC can be charged using various methods including constant current, constant power, constant voltage or by paralleling to an energy source (i.e. battery). If an EDLC is configured in parallel with a battery, adding a low value resistor in series will increase the life of the battery.

5、串联 Series connection

对于大多数应用而言，单个EDLC的电压过低（2.7V或3.0V），需通过串联电容器达到更高电压的使用要求。由于每个EDLC在电容和阻抗上有轻微的差别，应采取电路均衡以防止某单体过充而造成模组性能劣化。

The voltage of single EDLC is too low (2.7V or 3.0V) for most applications. So EDLC connection in series is used to obtain higher voltage for those application. Since there is slight difference between each EDLC in capacitance and resistance, circuit balance should be considered in the module to prevent single cell exceeds the rated voltage during charge, which would cause performance degradation of the module.

6、焊接 Welding

焊接过热会导致EDLC电性能退化、漏液或内压上升。EDLC焊接应遵循以下具体指引：

不能把EDLC浸入已熔解的焊锡中，只能在其导针或焊脚上粘上焊锡。

- ◆ 确保EDLC外部套管不与PCB或其它组件直接接触，焊锡温度过高会导致套管收缩或破裂。
- ◆ 避免EDLC在裸露的电路板上工作，以防止发生短路。

- **手工焊接：**

避免EDLC外部套管与烙铁接触，否则套管会熔化或破裂；焊嘴温度建议低于 350°C ，焊接持续时间少于4秒钟；应尽可能减少烙铁与EDLC焊脚直接接触的时间，以免过热导致EDLC性能不良。

- **波峰焊：**

给PCB预热不应超过60秒钟，预热温度不高于 100°C ，浸锡应使锡层厚度达到0.8mm或更厚。

下表波峰焊接信息仅适用于导针型产品：

Wave soldering information listed in following table is used only for leads type EDLC:

焊锡温度 Solder Bath Temperature (°C)	建议焊锡时间 Recommended solder duration (second)	最大焊接时间 Maximum Solder duration (second)
220	7	9
240	7	9
250	5	7
260	3	5

- **回流焊：**

除非规定有明确的额定耐回流焊接温度，否则EDLC不能使用回流焊接，而应使用红外线或传送加热方式进行焊接。

Excessive heat may result in deterioration of the electrical properties of the EDLC and electrolyte leakage or internal pressure increasing. Follow the specific soldering instructions listed as below:

- ◆ Do not dip EDLC body into melted solder. Only the lead or welded leg of the EDLC can immerse solder.
- ◆ Ensure there is no direct contact between the sleeve of the EDLC and the PCB or any other component.

Excessive heat may cause sleeve to shrink or crack.

- ◆ Avoid installing the EDLC on the exposed circuit board to prevent electrical shorts
- Hand welding:

Do not contact the sleeve of EDLC with soldering iron, otherwise the sleeve will melt or rupture. The recommended temperature of the soldering rod tip is less than 350°C and the solder duration should be less than 4 seconds. Minimize the time that the soldering iron is in direct contact with the terminals of the EDLC, as excessive heat of the terminal of EDLC may lead to deterioration of EDLC.

- Wave soldering:

Use a preheating time not more than 60 seconds for PCB, and preheating temperature should be limited to less than 100°C. Let the thickness of immersion tin layer to be 0.8mm or thicker.

- Reflow soldering:

Do not use reflow soldering unless there are specific rated soldering temperature. Use infrared or convection heating method on the EDLC instead.

7、纹波电流 Ripple Current

EDLC相比于铝电解电容器具有更高的内阻，在纹波电流中容易受内部热量的影响而使ESR升高，寿命缩短。为了避免过热造成电解液分解、ESR增加及寿命缩短，建议在最大纹波电流下工作时EDLC表面温度增加不超过3°C。

EDLC has a higher resistance than aluminum electrolytic capacitor, so it is more susceptible to internal heat generation when exposed to ripple current. The maximum ripple current recommended should not increase the surface temperature of the EDLC by more than 3° C, to avoid heat generation which leads to electrolyte decomposition, increased ESR and reduced life time.

8、贮存 Storage

不要在以下环境中长期储存EDLC：

- 高温/高湿环境。
- 阳光直射，粉尘环境。
- 直接与水、盐水、油或其它化学品接触。
- 直接与腐蚀性材料、酸、碱金属或有毒气体接触。
- 冲击或振动环境。

Do not store the EDLC in the following environments:

- High temperature / high humidity environments.
- Direct sunlight, dust environment.
- Direct contact with the water, salt, oil or other chemicals.
- Direct contact with corrosive materials, acids, alkalies or toxic gases.
- Shock or vibration environments.

9、运输 Transportation

EDLC的国际运输受到US DOT (运输部) /IATA的规定；正确的国际运输产品编码是UN3499 Capacitor: electric double layer (with an energy storage capacity greater than 0.3Wh) (双电层电容，储电量大于0.3Wh)

EDLC are regulated by the US DOT / IATA transportation regulations. Proper shipping name for EDLC is UN3499 CAPACITOR, electric double layer (with an energy storage capacity greater than 0.3Wh).

10、紧急事故应用程序 Emergency procedures

如果发现EDLC过热或是闻到气味，应立即断开与EDLC连接的电源和负载，让其降温，然后进行正确处理，不可让脸或手接触过热的EDLC；如果EDLC发生漏液或防爆阀打开，请与我司联系索取材料物质安全资料表（MSDS）。

如果暴露于电解液：

- 皮肤接触：用肥皂水和清水彻底冲洗皮肤。
- 眼睛接触：用流动清水或生理盐水冲洗，就医。
- 吸取：立即用水漱口，就医。

If you detect the EDLC overheating or if you smell unique odor, immediately disconnect any power or load to the EDLC. Allow the EDLC to cool down, then dispose it properly. Do not expose your face or hands to an overheating EDLC. Contact the factory for a Material Safety Data Sheet if the EDLC leaks or vents.

If exposed to electrolyte:

- Skin contact: Use soap and water thoroughly wash skin.
- Eye contact: Flush with flowing water or saline, and immediately ask for medical treatment.
- Ingestion: Immediately wash with water and ask for medical treatment.

11、一般性安全考虑 General safety consideration

EDLC在使用或测试完后，需将其电压放电至0.1V以下，以避免短路产生安全隐患。

如果过度充电、反向充电、焚烧或高于150°C加热，EDLC有可能发生防爆阀爆裂。不要压挤、损伤、穿刺或拆解EDLC，滥用可能导致铝壳发热造成高温烫伤或烧伤。

不要随意丢弃EDLC，应根据当地法律法规处置。

Make sure the EDLC is discharged to below 0.1V at the end of use or test to avoid potential safety hazard caused by short circuit.

EDLC may vent or rupture if overcharged, reverse charged, incinerated or heated above 150° C. Do not crush, mutilate, nail penetrate or disassemble the EDLC. Abuse of EDLC may result in high temperature on aluminum shell which may cause burn hazard.

Do not carelessly dispose EDLC in trash, but dispose according to local regulations.

企业资质

Qualification

ISO 9001



ISO 14001



IATF 16949



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